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APPLICATION NO. FILING DATE		FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.		
10/017,734 12/18/2001		Baowei Kang	B784.312-1 8855			
164	7590 03/27/2003					
	LANGE, P.A.	EXAMINER				
312 SOUTH	Y & LANGE BUILDING THIRD STREET LIS. MN 55415-1002	NGUYEN, KHIEM D				
MINNEAFOI	213, MIN 33413-1002	ART UNIT	PAPER NUMBER			
			2823			
			DATE MAILED: 03/27/2003			

Please find below and/or attached an Office communication concerning this application or proceeding.

4}			Application	No.	Applicant(s)	
Offic	Action Summary	10/017,734	10/017,734			
		Examiner		Art Unit		
			Khiem D Ng		2823	
The Period for Re	e MAIL ply	LING DATE of this communication a	ppears on the c	over sheet with the d	correspondence add	ress
THE MAIL - Extensions after SIX (6) - If the period - If NO period - Failure to re - Any reply re	ING D of time n MONTH for reply for reply oply within ceived b	O STATUTORY PERIOD FOR REF DATE OF THIS COMMUNICATION may be available under the provisions of 37 CFR HS from the mailing date of this communication. by specified above is less than thirty (30) days, a really by specified above, the maximum statutory perion in the set or extended period for reply will, by status by the Office later than three months after the mail adjustment. See 37 CFR 1.704(b).	I. 1.136(a). In no event, pply within the statutor d will apply and will exute ute. cause the applica	however, may a reply be tir y minimum of thirty (30) day goire SIX (6) MONTHS from tion to become ABANDONE	mely filed rs will be considered timely. the mailing date of this cor D (35 U.S.C. 8 133)	nmunication.
1)⊠ Res	sponsi	ive to communication(s) filed on 23	3 December 20	<u>02</u> .		
2a)∐ Thi	s actio	on is FINAL . 2b)⊠ 1	This action is no	n-final.		
3)∏ Sin clos Disposition o	sed in	s application is in condition for allowaccordance with the practice under ms	wance except fo er <i>Ex parte Qua</i>	or formal matters, p yle, 1935 C.D. 11, 4	rosecution as to the 153 O.G. 213.	merits is
4)⊠ Clair	ກ(s) <u>1</u>	<u>1-7</u> is/are pending in the application	n.			
4a) C	of the	above claim(s) 1 is/are withdrawn	from considerat	ion.		
•		is/are allowed.				
6)⊠ Clair	n(s) <u>2</u>	<u>-7</u> is/are rejected.				
7)☐ Clair	n(s) _	is/are objected to.				
8)∏ Clair Application Pa		are subject to restriction and	or election requ	uirement.		
9)∐ The s	pecific	cation is objected to by the Examin	ier.			
		g(s) filed on <u>18 December 2001</u> is/		ted or b) objected t	to by the Examiner.	
		may not request that any objection to t				
		ed drawing correction filed on			ved by the Examiner	•
If ap	prove	d, corrected drawings are required in r			·	
12) The o	ath or	declaration is objected to by the E	xaminer.			
Priority under	35 U.	.S.C. §§ 119 and 120				
13)⊠ Ackn	owled	Igment is made of a claim for foreig	gn priority unde	· 35 U.S.C. § 119(a)-(d) or (f).	
a)⊠ All	b)	Some * c) ☐ None of:				
1.	Certi	ified copies of the priority documer	nts have been r	eceived.		
2.	Certi	ified copies of the priority documer	nts have been re	eceived in Application	on No	
3. <u></u> * See th	a	ies of the certified copies of the pri application from the International B ched detailed Office action for a lis	ureau (PCT Ru	le 17.2(a)).		tage
		ment is made of a claim for domes		•		polication)
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Attachment(s)						
) 🔲 Notice of Dra	aftspers	es Cited (PTO-892) son's Patent Drawing Review (PTO-948) ure Statement(s) (PTO-1449) Paper No(s) <u>(</u>	4) 5) <u>6</u> . 6)		(PTO-413) Paper No(s). atent Application (PTO-	
Patent and Trademark O-326 (Rev. 04-0		ffice A	Action Summary		Part of P	aper No. 8

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DETAILED ACTION

The non-final rejection as set forth in paper No. (5) is withdrawn in response to applicants' amendments.

A new rejection is made as set forth in this Office Action.

Claims (1-7) are pending in the application.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 6-7 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 6, line 1. It is unclear what "low-power-loss" power semiconductor switching devices encompass?

In claim 6, line 5. It is unclear what "finally near" is referred to. If a particular position is intended it must be clearly recited.

In claim 6, line 7, delete "general" because it does not appear to limit the claim.

In claim 6, line 9. It is unclear what "high-temperature" encompasses? If a particular ranges of temperature is intended it must be clearly recited.

In claim 6, line 9, delete "and so on" because it does not appear to limit the claim.

In claim 6, line 11, delete "such commonly used techniques as" because it does not appear to limit the claim.

In claim 6, lines 12-13. It is unclear what "a required value" encompasses? If a particular value of thickness is intended it must be clearly recited.

In claim 6, lines 14. It is unclear what "a required thickness" encompasses? If a particular value of thickness is intended it must be clearly recited.

In claim 6, line 19. It is unclear what "low temperature" encompasses? If a particular ranges of temperature is intended it must be clearly recited.

In claim 6, lines 18-19. It is unclear when only the "low-temperature processes occur".

In claim 7, line 1, delete "considered to be" because it does not appear to limit the claim.

Claim 6 recites the limitation "the low-concentration side" in line 8 and "the high-concentration side" in line 10. There is insufficient antecedent basis for this limitation in the claim.

Claim 6 recites the limitation "the general frontside structure" in line 7. There is insufficient antecedent basis for this limitation in the claim

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

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Claims 2-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over the applicant's admitted prior art of this application (AAPA) in view of Chang et al. (U.S. Patent 5,753,529).

AAPA discloses a method for fabricating low-power-loss power semiconductor switching devices wherein the fabrication is in the following sequence (See Background of the Invention on page 1-4 of this application):

fabricating a nonuniformly doped n-type substrate which contains a diffused n+layer on one side, wherein the diffused layer, which is finally near to the backside p+emitter, is formed in the first step of this procedure before the thinning of the substrate (page 1, line 18 to page 2, line 26);

fabricating the general frontside structure of an IGBT (page 2, lines 2-3) on the low-concentration side of the n-type substrate using ion implanting, high-temperature diffusion (page 3, lines 16-17); and

forming the backside p+ emitter with a required thickness by ion implanting into the surface of the diffused-layer (page 2, lines 5-6 and page 3, lines 18-19);

AAPA fails to explicitly disclose thinning the wafer from the high-concentration side of the substrate by grinding and polishing so that the thickness of the residual diffused-layer is decreased to a required value as recited in present claim 6.

Chang discloses (FIGS. 1-12 and related text) fabricating a frontside structure of an IGBT (col. 2, lines 5-11) on the low-concentration side of the n-type substrate 10 using ion implanting and high-temperature diffusion and thinning the wafer from the high-concentration side of the substrate by grinding and polishing so that the thickness of

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lines 16-19).

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the residual diffused-layer is decreased to the range of approximately between 5 and 100 µm (col. 6, lines 9-28). Chang also discloses forming the backside p+ emitter by ion implanting into the surface of the residual diffused-layer and depositing metals 104 on the surface of the backside p+ followed by sintering/alloying (col. 6, lines 29-44). It would have been obvious to one of ordinary skill in the art of making semiconductor devices to combine the teaching of AAPA and Chang to enable the residual diffused-layer of AAPA to be formed and furthermore to reduce the thickness of the substrate to the minimum necessary for electrical functioning of the transistors formed therein (col. 6,

Neither AAPA nor Chang disclose the ranges for the thickness of the backside p+ emitter, the implanting dose of the backside p+ emitter, the doping concentration of the n-type residual diffused-layer and the low temperature as recited in present claims 2, 3, 5 and 7.

However, it would have been obvious to one of ordinary skill in the art of making semiconductor devices to determine the workable or optimal ranges for the thickness of the backside p+ emitter, the implanting dose of the backside p+ emitter, the doping concentration of the n-type residual diffused-layer and the low temperature through routine experimentation and optimization to obtain optimal or desired device performance because the thickness of the backside p+ emitter, the implanting dose of the backside p+ emitter, the doping concentration of the n-type residual diffused-layer and the low temperature are result-effective variables and there is no evidence indicating the thickness of the backside p+ emitter, the implanting dose of the backside p+ emitter, the

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doping concentration of the n-type residual diffused-layer and the low temperature are critical and it has been held that it is not inventive to discover the optimum or workable range of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khiem D Nguyen whose telephone number is (703) 306-0210. The examiner can normally be reached on Monday-Friday (8:00 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chaudhuri Olik can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 746-9179 for regular communications and (703) 746-9179 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

K.N. March 22, 2003

George Fourson
Primary Examiner